to have daughters has no resource but to find a still weaker husband. The thesis, if accepted, should beget humility in those male parents who have large families of lusty sons. J. A. T.

RÖNTGEN RAYS IN MEDICINE AND SURGERY.

The Röntgen Rays in Medicine and Surgery as an aid in Diagnosis and as a Therapeutic Agent. By Francis H. Williams, M.D. (Harvard). Pp. xxxii+704; 401 illustrations. Second edition, with appendix. (New York: The Macmillan Company; London: Macmillan and Co., Ltd.) Price 25*s.* net.

THE second edition of this excellent work was called for because the first was unexpectedly exhausted within three months, and we congratulate the author upon his deserved success. Only those acquainted with the subject can appreciate how difficult it is for any author to give a correct view of the progress of such a branch of science as the X-rays, because of the great advances made within a comparatively short period, the number of authors engaged in research and the nature of the subject itself. As might have been expected, Dr. Williams fully understands this, because in his preface he states that the work is rather a report of progress than a final presentation of a growing subject. Further, owing to the short time at his disposal for the preparation of a second edition, he has only been able to add some forty pages, chiefly on apparatus and the therapeutic uses of the X-rays. This will be found in the appendix.

Dr. Williams very properly introduces his subject by reference to the principles of physical science, and, without overburdening the student, he tells what is necessary for their appreciation. Next he deals in the most practical way with the equipment necessary for photographic and therapeutic work. Having thus prepared the way, he enters into a full description of the normal conditions of the cavities of the body so that the observer may be able to appreciate deviations from the normal, a principle which will be thoroughly appreciated by all those who are seeking for information from the clinical aspect. The pathological changes are well described by photographic illustrations, diagrams and histories of selected cases.

A noticeable feature of the work is the amount of attention devoted to what might be called the medical aspect of the subject as opposed to the surgical. This is interesting, because for a long time many who believed in the value of X-rays in the detection of fractures, dislocations of the hard structures and foreign bodies were inclined to think that the use of X-rays would be limited to these. If any are still of this opinion we commend them to a perusal of this work.

The third great step in the development of X-rays in medicine was their application in diseased structures, and the present position of their therapeutic action is frankly and fairly stated in these pages.

While it is true that the work gives a very strong representation of the methods employed in America—indeed, the illustrations themselves show that the work has not been produced in any European laboratory—still the labours of others have not been neglected. In future editions the work might be enhanced in value by a reference to what has been done in this country and the European schools of medicine, a fact which is admitted by the author in his preface, because he states that he had intended to include as complete a list as possible of the publications on the subject. This was not found possible on account of its extent, so he adds that had he foreseen this he would have referred in the text to many other important papers.

The work is well written by one thoroughly familiar with the subject, is profusely illustrated, and to those who desire a guide to the study of the subject the work may be thoroughly recommended; and this remark applies to students and practitioners.

OUR BOOK SHELF.

Elementary Geometry. By W. C. Fletcher, M.A., Head Master of the Liverpool Institute; late Fellow of St. John's College, Cambridge. Pp. 80. (London: Edward Arnold, n.d.) Price 1*s.* 6*d.*

THIS is a very small book and a very good one. Its object is to teach geometry to boys without hindering and wearying them with metaphysical subtleties, or requiring them to express the proofs of propositions with that pedantic recitation of details—that parody of logical accuracy—which has long been identified with the study of Euclid.

The author is perfectly correct when he says that his little book "contains the whole substance of Euclid i.–iv. and vi. except the elegant but unimportant proposition, iv. 10."

The branches of the subject are taken in the following order:—Angles, triangulation (*i.e.* the discussion of the properties of triangles), quadrilaterals, loci, proportionals, circles, tangents, areas, maxima and minima, this last section being very short and merely illustrating what is meant by a maximum or a minimum. There is no formality whatever in the proofs, the most simple propositions being often left to the student with a hint sufficient for the solution. Each section, besides terminating with a number of simple exercises (well within the power of the beginner), contains a number of numerical illustrations to be worked by actual drawing with instruments. This is precisely the kind of teaching which is now being advocated by those who have taken up the question of the reform of mathematical teaching.

In propositions relating to proportion—as, for example, that a line drawn parallel to the base of a triangle divides the sides in the same ratio—the author explicitly states that he assumes two magnitudes to have a common measure, and that the difficulty which arises in the case in which they have not "had better be disregarded for the present." The reason for thus making an *essential* difference between "commensurable" and "incommensurable" quantities of the same kind is not obvious, since any proposition which holds for the former will be admitted, even by the beginner, to hold for the latter when it is pointed out that the unit magnitude may be taken so small that the distinction between commensurable and incommensurable quantities practically disappears. The proposition that the sum of two sides of a triangle is greater than the third is proved by the definition of a right line as the shortest distance between two points. The nature of a tangent as the limiting position of a chord is that which the author adopts. This also is in accordance with modern notions, and it offers no difficulty whatever even to the merest beginner. In p. 42, line 4, for "place them so that two pairs of sides are parallel,"

read "place them so that any two corresponding sides are parallel." In p. 63, ex. 19, for "prove also that OT, ON equal OP^2," read "prove also that OT.ON equals OP^2."

Diagrams of Mean Velocity of Uniform Motion of Water in open Channels, based on the Formula of Ganguillet and Kutter. By Prof. Irving P. Church. 11 Diagrams +1 page Text. (New York: Wiley and Sons; London: Chapman and Hall, Ltd., 1902.)

THIS little work, in spite of its ponderous and somewhat ambiguous title, is a useful and workmanlike collection of curves from which may be obtained the value of the mean velocity v in the empirical formula $v = c\sqrt{rs}$, so much used in computing the flow of water in channels.

To the ordinary reader the term "mean velocity of uniform motion" is puzzling; but anyone versed in hydraulics will understand that the author wishes, very properly, to restrict the application of his curves to cases where the rate of flow is constant, *i.e.* where the same number of cubic feet or gallons pass a given section of a channel of uniform cross-section every second.

In the formula the trouble is with the coefficient c, which is not independent of r and s—the hydraulic mean depth or "hydraulic radius" and the slope. The coefficient may be computed, for channels of different materials, from well-planed timber to earth and stones, by the formidable law of Ganguillet and Kutter,

$$c = \frac{\frac{1\cdot811}{n} + 41\cdot65 + \frac{\cdot00281}{s}}{1 + \frac{n}{\sqrt{r}}\left(41\,65 + \frac{\cdot00281}{s}\right)},$$

where n is the arbitrary constant which ranges in value from 0·009 to 0·035 in the two extreme cases cited.

Very few people, we imagine, actually calculate c in this way, as tables by Trautwine and others give its value for all likely values of n, r and s. Prof. Church has, however, gone a step further, and his diagrams give values, *not* of c, but of v, thus avoiding the further calculation usual after c is found from tables.

There are eleven diagrams, each corresponding to a particular value of n, the vertical lines in each diagram showing "slopes," inclined lines "hydraulic radii," and horizontal lines "mean velocity" v. The intersection of any three of these lines satisfies the relations referred to, and shows for the selected values of n, r and s the required mean velocity in feet per second, which, multiplied by the cross-sectional area of the channel in square feet, gives the flow in cubic feet per second.

A test or two, worked out from the formulæ, shows the curves to be accurate enough for practical purposes.

Thus, selecting $n = \cdot01$, $r = 10$, $s = 2\cdot0 \div 1000$, the calculation gives

$$c = \frac{\frac{1\cdot811}{\cdot01} + 41\cdot65 + \frac{\cdot00281}{\cdot002}}{1 + \frac{\cdot01}{3\cdot162}\left(41\cdot65 + \frac{\cdot00281}{\cdot002}\right)} = \frac{224\cdot155}{1\cdot136} = 197\cdot3$$

and

$$v = 197\cdot3\sqrt{10 \times \cdot002}$$
$$= 27\cdot89 \text{ feet per second.}$$

The diagram gives v about 28.

In another test where $n = \cdot03$, $r = 10$, $s = 2\cdot0 \div 1000$, the diagram gives v about 10·5; calculation makes it 10·38.

There is no doubt, therefore, that Prof. Church has compiled a real "labour-saver" for those who have to make numerous calculations of the kind referred to.

Near the end of the author's explanation he mentions the application of the diagrams to cylindrical pipes and sewers "running full or half-full." We would point out that the rule $v = c\sqrt{rs}$ is not applicable with success to pipes running full, though various American writers attempt to use the law in this sort of universal sense. Much more authentic formulæ are available for calculating the flow in pipes, and the curves given in this little work should not be applied to that purpose. R. G. B.

A First Course of Chemistry (Heuristic). By J. H. Leonard, B.Sc. Pp. vi + 134. (London: John Murray, 1902). Price 1*s.* 6*d.*

THIS little work provides a course of elementary chemistry resembling the well-known course which was drawn up some years ago by Prof. Armstrong and endorsed by a British Association committee. Great pains are taken to make the teaching undogmatic and to imbue the pupil with the zeal of a scientific inquirer. The topics include a study of chalk, lime and carbonic acid, air, water, combustion, acids and salts. Though the work cannot be pronounced superior to some that have already been written with the same object, it gives a good representation of what many people now think the right way of approaching elementary chemistry. On any system the teaching of elementary chemistry will for long remain full of difficulties and inconveniences. We notice that on p. 43 there is an instruction to collect oxygen by displacing air in an inverted cylinder, and on the next page an experiment, correctly enough described, perhaps, leading to the conclusion that oxygen is lighter than air. A. S.

An Elementary Book on Electricity and Magnetism and their Applications. By Profs. D. C. Jackson, C.E., and J. P. Jackson, M.E. Pp. xi+482. (New York: the Macmillan Company; London: Macmillan and Co., Ltd., 1902.) Price 7*s.* 6*d.*

THE object of the authors has been to write a book which will serve both as an elementary text-book and as an interesting account of the subject for the general reader who has a taste for the science. With this in view they have naturally taken industrial development as a guide, and wherever possible have shown the connection between the simple principles of the science and their technical applications. As the general reader is usually ill-equipped with mathematics, we find that little more than the simplest equation is used in the book.

Each chapter is followed by questions. Here are some of the questions which come at the end of the first chapter:—

"How much is known about the real constitution of electricity?"

"What is electricity supposed to be by some scientists?"

"What kind of electricity will a positively charged ball induce?"

The book contains twenty-three chapters, and from chapter xv. to the end the subject-matter is principally technical applications. Thus polyphase motors, electric welding, cooking and Röntgen rays, and other new uses are each described in their appropriate chapters.

S. S.

The Face of Nature. By the Rev. C. T. Ovenden, D.D. Pp. ix + 188. (London: John Murray.) Price 2*s.*

IN this little volume we have the material for several "popular readings in elementary science," the subjects of the four chapters being weather forecasting, vegetable life, the record of the rocks, and stones from boulder clay. The village clergyman or teacher who desires to show that there are "sermons in stones" and other natural objects and phenomena will find Canon Ovenden's short addresses of service.

A few points will, we think, lead to misconception if accepted as they now stand. For instance, a barometer is said to weigh the air, whereas it really measures pressure. Again, it is only true in the northern hemisphere that a "cyclone spins always against the hands of a clock, and the anticyclone rotates with the hands of the clock."